This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

RAILWAY ACCIDENTS.

[illegible]

[illegible]

[illegible]

HE1783 G7W9

48 12

The Hopkins Library
presented to the
Leland Stanford Junior University
by Timothy Hopkins.

HE1783
G7 W9

[illegible]

[illegible]

RAILWAY ACCIDENTS.

"LOOK BEFORE YOU LEAP."

RAILWAY ACCIDENTS:

THEIR CAUSE AND CURE.

BY THOMAS WRIGLEY.

LONDON:
SIMPKIN, MARSHALL, AND CO.
1871.

LELAND STANFORD JUNIOR
LIBRARY
UNIVERSITY.

H.3661.

BURY: PRINTED BY J. HEAP.

RAILWAY ACCIDENTS.

The dangers attendant on Railway travelling have been exciting considerable attention of late, in consequence of a rather unusual number of so-called accidents having occurred, some of them accompanied by serious injuries and extensive loss of life. For the moment the public have taken alarm, and are evidently anxious that "something should be done." My name having been rather prominently associated with this subject for some years, I have received many applications, all earnestly urging me to "write to the *Times*," or to do something to bring the question of Railway accidents more formally and prominently under public view. I have been asked, repeatedly, whether my silence on this subject for so long a time has been caused by any change of opinion as to the possibility of preventing these dreadful catastrophes. My reply to all such inquiries and appeals has been, that I have in no degree changed my opinions as to the vicious principle on which the present system of Railway signalling is based, nor as to the constant and unnecessary risks and dangers which it entails.

I remain firm in my belief that the "Affirmative" principle is not only the *best*, but the *only* means of avoiding those casualties to which Railway travelling is now so liable; and, to use the words of one of the most experienced Railway officials in the kingdom, I believe "there can be no safety without it."

It is now more than twenty years since I propounded this theory. Seventeen years ago I addressed two letters to the *Times* on the subject, which I can now refer to with great satisfaction, because I find nothing to alter; and my experience since that time has only tended to strengthen my belief in the truth and soundness of the opinions I then entertained, and to remove whatever doubt I may have had as to the practicability of the plan which I proposed.

Since the time to which I have referred, this question has been ever before me, and occasionally I have drawn public attention to the subject; but I have been reluctant to obtrude my views unnecessarily, because I found myself in advance of public opinion as represented by the Press, and without the concurrence of this great power in the State I felt that no practical good would result from pursuing the subject. My decision therefore was to wait the natural course of events, in full confidence that the time would come when the necessity for a total change in the principle on which the working arrangements of Railways were and are still based, would become imperative.

If it were possible to render the present system, which has now been in operation for forty years, effective as a means of securing the public safety, there has been ample time for the purpose. Is it not, however, the fact that we are at the present time under a greater state of alarm and disquietude than at any previous period? Was there ever a time when Railway travellers had so much reason for anxiety about their personal safety? The answer to these questions will be found in the records of Railway casualties, which have been during this period constantly increasing in number and fatality. I cannot suppose and do not believe that Railway Directors and Managers are indifferent to this state of things.

The fact, however, remains, that during this period we have been experiencing a steady and continuous increase in what are called Railway accidents, out of all proportion to the extension and increase of Railway facilities; and whatever else may be said in defence of the system that has produced these unpleasant consequences, it does appear that the older it grows the more dangerous it becomes. Nor do I believe that its powers for mischief are by any means exhausted.

The same cause is still in operation; and I will venture to predict that the longer the system is continued, the more active will be the work of death and destruction.

That Railway Directors and Managers have not succeeded according to their expectations and desires in securing the public safety, I think they will fully admit; and it is a matter of surprise to me that this consciousness of failure should not long ago have induced a suspicion, that the system to which they have so tenaciously held may, after all, be to some extent the cause of their disappointment. If they would, in the interest of the public and in their own interest as Railway proprietors, allow the question to be an open one, and discuss it without prejudice or jealousy of outside interference; and above all, if they would come to the discussion as individuals, and not in the compact phalanx of a Board, I should have no fear of the result. I think it could be shown that the failure to achieve that which I am sure they desire to accomplish, is clearly traceable to the erroneous and irrational basis on which their working arrangements are founded.

They set out with the conviction that by the mere force of their will, expressed in a code of rules and regulations, they can establish as the foundation of their proceedings a state of undeviating punctuality, regularity, and unfailing performance of duty. On what ground they can hope to secure an exemption from those errors and frailties which are said to belong to our nature, I am at a loss to conceive. It is this futile effort to soar above the level of humanity, that constitutes the fundamental error in their proceedings. The collisions to which we appear to be so liable, and from which such disastrous consequences ensue, are in the great majority of cases caused by some irregularity, some deviation from that prescribed order of things which was intended to render such occurrences impossible.

Now, I can believe in the possibility of rendering these irregularities innocuous by interfering so as to prevent their taking effect by causing collisions, but I have no more faith in the possibility of preventing irregularities from time to time, than I should have in an attempt to control the elements that tend to produce them.

Nothing has surprised me more than this apparent inability on the part of the Press and the public, to appreciate the importance of the distinction which I draw between that which I believe to be possible, and that which I hold to be impossible. Whenever one of those unfortunate casualties occurs which has been more than ordinarily destructive of human life, we find the public attention at once directed to matters of detail. In the judicial inquiry that follows, the jury are intent upon examining the working arrangements; and if they can record a censure and a recommendation as part of their verdict they are perfectly satisfied. A train is found to have been some minutes behind time; or two trains appear to have been started too close upon each other; a pointsman is overworked; or the staff at a particular station is short-handed; all matters which may be true in themselves, but tend in no degree to alter the system, *which permits trivial derangements of this character to be the immediate or remote cause of disaster*.

In this way the public are led away from the real question at issue. The arrangements, it is thought, are simply imperfect; and the conclusion they come to is, that by more perfect arrangements in the future all will be well. The question as to the *possibility of avoiding* similar irregularities and defects is never considered. Instead of plainly and honestly stating that under no system of working whatever can these interruptions and irregularities be prevented, the authorities encourage the *public to adopt* the very opposite conclusion.

What is there, I ask, in a Railway, or the people connected with it, so exceptional as to exempt them from the contingencies which attach to all human affairs? Of all human inventions I should say that a Railway is more than ordinarily liable to derangements from a variety of causes, some of them entirely beyond control. The strain to which the materials are subjected, the speed at which the trains are forced along, the effect of atmospheric influences upon the moving mass, independent of the liability to error and failure in the performance of duty of that multitude of people scattered along the line of railway, on whom the safety of the train and passengers is made to depend, all conspire to render complete regularity and punctuality an impossibility.

But if these were not sufficient, the public themselves are perhaps the most fruitful cause of unpunctuality and irregularity. They assert their right to travel by any train that they may select, in any numbers they choose, totally regardless of the resources at the disposal of the Company; and where the demands are thus uncertain and unlimited, and the power and means of accommodation, though large, yet limited, it seems a little unreasonable to expect undeviating punctuality and regularity.

I have dwelt at greater length upon this part of the subject than I should otherwise have thought necessary, did I not feel that here is the very root of the evil.

For until this dream of securing unfailing performance on the part of Railway servants, and unfailing punctuality and regularity in the movement of trains is discarded; until the notion of evoking perfect results out of imperfect materials as a means of securing safety be abandoned, we shall be in no condition to deal with this subject, as it must and will be dealt with sooner or later.

The idea of establishing, by means of rules and regulations, such a system of perfect order and regularity as to enable the trains upon a Railway to move at fixed distances from each other with all the precision of the solar system, is admirable as a theory, but we are deficient in the means to work it out. We should require that the code of laws should be framed by immaculate judgment, and that the people who are expected to observe them should be infallible; and even then we should fall very far short of that perfect result where irregularity would find no place. Contend against it as we may, human nature and the work of human hands remain what they have been from the beginning. "Man is prone to error," we have been told, and we find it constantly verified. Would it not be better to lower our standard to the level of our condition, and deal with things as we find them? Then although we cannot hope to avoid irregularities in the working of a Railway, we may by timely precautions prevent the evil consequences to which they tend.

I can see no reason why temporary and accidental obstructions on a Railway should necessarily be followed by collisions, any more than the closing of a turnpike gate or the upsetting of a vehicle should involve similar consequences on a highway. It is all a question of observing the old adage, "Look before you leap;" and though the speed of a train does not permit of this being done in the ordinary way, it is possible by a right use of the signal to do it with equal certainty and effect.

Before I proceed to compare the system of working now in operation, which I denominate the "Negative System," with that which I recommend, and which I denominate the "Affirmative System," I will state one or two leading conditions which I deem essential to the safety of trains passing along a Railway.

The engine driver of a train being the sole person who has the power to control its movements, and the safety of the train and passengers being entirely dependent on the judgment and care with which this power is exercised, he ought to be held responsible for the due performance of this important duty; and to enable him to perform this duty effectively, he should be placed in a position to demand and obtain, at such points and places along his route as are liable to interruption, accurate and positive information as to the then existing condition of the line in advance of him.

This information representing the actual state of things at the moment of the train's approach must be furnished by the people on the spot, while the train is at such a distance from the point of possible danger as will admit of the engine driver bringing it up in case it should be necessary.

Without such positive information as will satisfy him that the line before him is free from obstruction, it should be imperative on the engine driver not to proceed.

If these conditions be observed, the danger from collisions will be in a great measure averted, and as accidents from any other cause are comparatively rare, we shall have done very much to secure that degree of safety of which Railway travelling is susceptible.

The Semaphore is the signal in general use. It is capable of exhibiting three signs :—

1st. The " All right ;" that is, with the signal arm depressed so as to be out of view.

2nd. The " Caution ;" that is, with the signal arm depressed half-way down.

3rd. The "Danger;" that is, with the signal arm at right angles to the signal post.

Under the Negative System, which is that now in use, the Semaphore signal is so balanced that when left undisturbed it will by its own action assume the "All right" position.

It will thus be seen that under ordinary circumstances, and in the absence of any supposed danger, the position of the signal when at rest will be that of "All right," signifying a "clear line;" but according to the rules, in the case of the line being obstructed from any cause so as to render the passage of a train unsafe, it is the duty of the people at the station to raise the signal arm to the position of "Danger."

This is the leading and peculiar feature of the Negative System, and I give it this name because the signal in its normal position of "All right" conveys no positive information. In passing along the line the engine driver, as a rule, sees the signals in their normal or permanent position of "All right," and in the absence of a signal to the contrary, he is obliged to *infer* that all *is* right.

It will be observed that this mode of using the signal fails to supply that positive information of the state of the line in advance of him, which I consider it essential that an engine driver should have before proceeding.

So long as this normal position of the signal is a true indication of the actual state of the line, *all will be well;* and *if* in the case of an obstructed line the rule be observed, and the danger signal is raised, *all may be well.*

There are, however, three possible contingencies, any one of which occurring may lead to most serious consequences. The danger signal *may not be set;* or, if set, *not in sufficient time;* and lastly, *the driver may not see it.* Now, although in each case there would be a clear neglect of duty, the possibility of such neglect is one of the most serious defects connected with the Negative System, and illustrates the danger of relying upon a strict observance of the rules. Without committing any wilful act, a man may neglect to set the signal from mere forgetfulness, or from pre-occupation of mind in his anxiety to remove any obstruction. He may be so placed as to be unable to set the signal in time, or the presence of approaching danger may so act upon a nervous temperament as to render him incapable of doing what is necessary at the moment.

That the driver *may not see the signal* when set against him is not only a possible occurrence, but one that happens much more frequently than is generally supposed; and for my part I should be disposed to make great allowances in such a case, because I think it is a necessary consequence of the training to which an engine driver is subjected, to induce a negligent look-out. He is in the habit of passing signals which he almost uniformly finds in one position, from which he has to *infer that which he ought to know;* and finding his course as a rule uninterrupted, he is insensibly induced to rely on its continuance, so that when danger does occur, he either does not see the danger signal when set, or he is unprepared to act upon it. The engine driver has no responsibility in respect to ascertaining the state of the line in advance; he is entirely dependent on the people along the line of Railway to give him timely warning of any dangers. If they do so, well and good; if they do not, he is powerless to obtain it, or to protect his train. The signals give no certain information as to the state of the line in advance, so that the engine driver's duty seems to be confined to covering certain fixed distances in certain fixed periods of time, and to stop and start as he is told.

In further illustration of the defects of the Negative System, I wish to point out the apparent impossibility of exercising the necessary check upon the proceedings of that large number of people along the line of Railway upon whose strict attention to their duties the lives of the passengers entirely depend. If they perform their duty, well and good; but if they do not, the train moves on to destruction, and the public suffer.

Nor do I see any practical mode, under the present system, of altering this state of things. True to its negative principle, in the absence of an accident every one is supposed to attend to his duty. We hear nothing of any neglect or breach of the rules until some disaster occurs, when an inquiry is instituted to determine who is to blame; and this is often a very difficult and in some cases an impossible task. The engine driver declares that the signal was not set, and on the other hand the station authorities as stoutly aver to the contrary. The matter is thus frequently left in doubt, and the delinquent escapes.

What we want is, that it should not require an accident to discover that there has been some neglect of duty, but that it should be detected in anticipation and as a means of prevention. But the most important thing to do is so to arrange that neglect of duty need not involve collision.

The Affirmative System that I have so many years advocated as the best, and, as far as my judgment and experience go, the only one upon which the working arrangements of a

Railway can be based with any regard to the safety of the trains passing along the line, proceeds upon the principle that nothing of that which is necessary to secure the safety of the train and passengers should be left in doubt; that the safety of the line of Railway in advance of a train should be clearly and distinctly ascertained by the engine driver in charge; that the signals from the station should be given in response to the whistle of the engine driver when he is in view of the signal, and that they should in all cases indicate *the state of things at the time.*

The engine driver being thus compelled before entering a station, &c., to demand from the people on the spot, a distinct assurance that the line in advance is free from obstruction, the safety of his train is virtually placed in his hands.

The distinction between the Negative and Affirmative System is, that the former assumes safety in the absence of a signal to the contrary, while the latter assumes "danger" in the absence of a signal distinctly affirming safety.

On the Negative System the line is always open except when the "Danger" signal is raised by the people in the station. On the Affirmative System the line is always blocked, except when the signal of "Safety" is exhibited by the station authorities in response to the whistle.

The signal used is the same in both cases. Its action is, however, altered on the Affirmative System, it being so balanced that when left undisturbed it will by its own action assume the normal position of "Danger"—viz., a red arm by day, and a red light by night; no provision being made or permitted by which the signal can be fixed in any other position; so that, the hand which depresses the signal being removed, it at once returns to its original position.

The line being thus at all points of probable danger constantly blocked, the engine driver on approaching a station must sound his whistle, and in this act demands liberty to pass; when, if there be no reason to the contrary, the signal arm will be depressed to the "All right" position, signifying that his course is clear. If otherwise, the "Danger" signal will remain immovable, a barrier to his further progress.

The distinction here between the Negative and Affirmative Systems is this, that in the former to stop a train an act has to be performed, that is, the "Danger" signal must be raised; on the latter system, to stop a train nothing requires to be done.

By this mode of action all danger from collision at or within the limits of a station is rendered impossible. No train can enter without the special permission of the authorities, so that the business of the station may proceed in perfect security.

There can be no further question as to the signal being set against an approaching train, this being its permanent position when left undisturbed.

The responsibility attending the admission of a train into a station rests solely with the station authorities, who, being on the spot, are alone able to see the line clear before admitting the train.

The engine driver under the Affirmative System will be placed in a responsible position. The signals by which his movements will be guided being all definite and positive indications of the state of the line in advance at the time, the duty of obtaining the necessary information before proceeding rests upon himself.

He must not sound his whistle until he is in view of the signal, that he may be assured, by witnessing its movements, that the people at the station are in attendance. To avoid unnecessary delay, it will require a good look-out on the part of the engine driver, so as to get a view of the signal at the earliest moment, and prompt and strict attention to the signal on the part of the people at the station.

This system will allow of no excuse for neglecting the signal, on the ground of fog, or any other cause that may tend to obscure the view. The duty of the engine driver under such circumstances being plain and peremptory, *he must see the signal* before sounding his whistle, and therefore he must creep cautiously on *until he finds it.*

Not the least of the advantages of the Affirmative System is the facility that it offers for continuous supervision. A travelling superintendent seated in the train without the knowledge of any person on the line, can see if the engine driver sounds his whistle before he comes in view of the signal, or if the signal is lowered before the whistle is sounded ; and he can see also whether there is any unnecessary delay in giving the signal ; and thus neglect of duty or breach of orders may be discovered without the necessity of an accident.

Although the Affirmative System of signalling can only claim to be effective at such stations and other parts of the Railway as are under the protection of a signal, the necessity which it enjoins of keeping a good look-out ahead, in order to avoid delay, will induce the same habit at other parts of the line, and thus tend greatly to make the driver detect any obstruction which may accidentally present itself between these points.

The moral effect upon the engine driver will be of the most salutary character. Hitherto he has been little better than an animated portion of the machine he drives, dependent for his own and his passengers' safety on a number of people along the line of Railway, any one of whom may by oversight or neglect of duty be the cause of irretrievable disaster, and all of whom are beyond his influence; without discretion or power to protect himself, with no knowledge of the condition of the road he is travelling over, beyond that which he can gather from the treacherous and doubtful Negative Signal; he is compelled to proceed on the faith that if anything occur to render the line before him unsafe, some one will give him timely warning. I cannot conceive any one in a more helpless and powerless position, or one more inconsistent with the weighty responsibilities that ought to attach to it.

With the power under the Affirmative System of demanding from each station as he approaches a positive assurance that he may proceed with safety, he will in a sense assume command of the road, with a power to enforce attention to those duties which have heretofore been more or less voluntary, but a strict observance of which is essential to the safety of the public.

Endowed with this power, he at the same time takes upon himself the responsibilities attached to it, and unless I am greatly mistaken in my estimate of the intelligence and disposition of engine drivers as a class, they would appreciate their new position, and acquit themselves of their duties with credit to themselves and safety to their passengers.

It will be seen that the Affirmative System, from the beginning to the end, is based on totally opposite principles to the Negative System now in operation.

It starts from the position that the safety of the train and passengers shall be the first consideration, and that all other questions shall be subordinate ; that without undervaluing rules and regulations as tending to order and discipline, no preconcerted arrangements, however perfect in themselves, can or ought to be relied upon so far as to justify their being acted upon without check ; that notwithstanding all preconcerted arrangements to secure an unobstructed line of Railway, it is still necessary at all stations and other points where danger is to be apprehended, that the safety of the road should be positively ascertained immediately in advance of an approaching train ; that the engine driver, being the only person who can control the movements of the train, should be charged with the responsibility of obtaining this information before he ventures to proceed.

To this system of working, assuming its superiority as a means of safety, some objections have been raised against its adoption.

It is said that it would involve delay; that it would necessitate the slackening of the train approaching a station in order to obtain the signal to proceed.

I frankly confess that if this were a necessary consequence of the Affirmative System I should hold that the delay was after all but common prudence, and a very rational and necessary mode of obtaining safety. I doubt very much the propriety, apart from all questions of signals or other matters, of permitting a train under any circumstances to dash through a station at forty or fifty miles an hour, encountering all the risks of points and crossings and other conveniences, incident thereto.

I can, however, see no reason why the Affirmative System should necessarily involve delay. That delay will occur occasionally I do not pretend to deny, but it will arise from one of two causes—either from an obstructed line, or from negligence either on the part of the engine driver in not sounding his whistle the moment he comes within view of the signal, or on the part of the signal-man in being away from his post when the whistle is sounded. In either case the delay may be excused in consideration of the safety it ensures.

Assuming, however, that the signal is placed so far down the line that the engine driver can see it at such a distance from the station as will enable him to pull up in case of necessity, and that the signal-man is where he ought to be, in close neighbourhood to the signal lever when the whistle is sounded, there need be no delay. To obtain the signal of "All right," if the line be clear, would be the work of an instant of time. The signal may be given before the sound of the whistle has ceased, and so as to render it unnecessary even to turn off the steam. Any unnecessary delay from inattention can be at once detected, and will be a matter for the authorities to deal with.

It is said that the drivers would from some inexplicable motive run past the signal. Why they should feel disposed to violate the rule in this case, and respect the rule as they do at all junctions,—the Affirmative System being there in universal use, and without which no Railway Company would dare to work for a single day,—I cannot explain; but, as I before said, the facilities for detecting acts of insubordination of this nature are of the easiest, and a sentence of three months to hard labour would, I think, have a beneficial effect.

Then the expense is objected to. I can scarcely bring myself to discuss this question of expense, nor do I believe any of the leading Companies would put it forward, if in other respects they could see the necessity of adopting the Affirmative System. It seems to me like balancing the lives of the passengers against a fraction of dividend.

But as a matter of economy I am far from admitting that, all things considered, it would entail any serious expense *per se*. It is only during a portion of the night, and that only in some third class stations, that any additional cost would be incurred. There are not many stations where traffic is passing during the night, that can be safely left without a watchman, and he would be competent for all the purposes of the signal.

But I would rather not discuss this matter of expense, not only because, as bearing upon the main question, it is unworthy of notice, but because it is at variance with the principle I have laid down—that the safety of the passengers shall take precedence over all other considerations. There is, however, one point of view from which I will notice it, and that is in reference to the enormous sums which are annually paid as "Compensation for Accidents and Losses". I see by the accounts of the London and North Western that in this case alone a sum averaging £120,000 per annum has been charged under this head for the last four years. If, as I confidently believe, the adoption of the Affirmative System should greatly reduce the number of accidents, there would be an ample saving to compensate for any small extra expense that might be incurred; and I cannot help thinking that it is worth the notice of all those who are interested in Railway property to consider whether, in reference to these pecuniary interests, it is not absolutely necessary that something should be done to reduce the cost which is annually incurred by so terrible a sacrifice of life and injury to persons, as these sums represent.

The occurrences of the last few weeks have given lamentable proof of the increasing insecurity attending Railway travelling. On the London and North Western Railway—generally considered one of the best managed Railways in the kingdom, with all the vaunted security of the Block System in operation, three collisions occurred in a day, within twelve miles of each other, one of them resulting in a sad sacrifice of life and serious injury to a great number of people. The fatal casualty at Harrow, by which thirteen or fourteen people lost their lives, and great numbers were maimed and otherwise disabled, was caused by one of those commonest of all collisions of which railway management is so fruitful. As far as my memory serves me—for I have no record at hand—the collision was caused by the five o'clock Express from Euston running into Harrow station at full speed during the time that a train of empty waggons was being shunted across the line into a siding, in order to allow the Express to pass.

There does not appear to have been the slightest pretence or excuse for this casualty, unless the presence of a fog at the time is to be admitted. Against this I protest most earnestly. A fog being one of those atmospheric changes to which we are liable, no system of working management can have much value in my estimation that does not provide against it.

As far as I can judge, the whole excuse offered in extenuation of this act of recklessness was, that in consequence of the fog the driver could not see the "Danger" signal, and I regret very much to see that the jury, by the line of examination and the nature of the evidence brought before them, were disposed to admit this plea. Much time was spent, and many witnesses were examined from the neighbouring districts, with the view of ascertaining the extent of the fog and its density at various points, and to what degree it was likely to obscure the view of a signal at a certain distance. All this had manifestly one object in view, viz., to compare the evidence of independent witnesses with the statement of the engine driver; and with what object, if not to exonerate him in case his statements as to the density of the fog were corroborated?

This inquiry furnishes a striking instance of the tendency, under clever management, to mislead the public. Instead of inquiring as to the steps which the Company took to prevent the fog being the cause of accident, the jury were at once led off to inquire as to the density of the fog.

The only conclusion that can be drawn from this course of examination is, that under certain circumstances an engine driver may be excused in passing a signal without observing its indications; that if a fog be sufficiently dense to obscure the signals, he may ignore them altogether; that while all other people are groping their way through a fog with more than usual care and caution, an engine driver with two or three hundred passengers in his train may assign a fog as a reason for less than the usual caution; that although signals are accounted necessary to safety during the day and clear weather, he may proceed without reference to them in case of a fog.

Against this doctrine I protest. I say that no possible contingency, neither darkness nor fog, not even a blown-out lamp nor a blown-down signal, can furnish the slightest justification for the assumption that *no signal* is equal to an "*All right*" signal. On the contrary, *no signal*, from whatever cause, ought to be equivalent to a *stop signal*; and a driver's clear duty under such circumstances is, the moment he finds himself unable to see the signal from the usual point of view, to turn off steam, and go cautiously up to the station at such speed as to prevent the possibility of a collision.

Now, although I am not prepared for one moment to excuse the engine driver on the score of there being a fog, I think that there is something to be said for him in palliation of the grievous error that he committed.

In commenting upon the various defects and evil tendencies of the Negative System, I pointed out the bad effects which must be produced upon engine drivers, especially express drivers, by the training to which they are subjected in having constantly to pass signals which never appear to change their position, but from which they have to *infer*, in the absence of a signal to the contrary, that the line before them is clear. If I remember rightly, it came out in evidence that during the whole of 1870 this five o'clock Express train had never been stopped at Harrow Station until the day of this unfortunate calamity. During nearly a whole year it would appear that this particular signal remained in one position, in so far as the engine driver of this particular train was concerned. With nothing to do on his own part to keep up his interest, nothing to see but a stereotyped form which to all appearance remained fixed and unalterable, with nothing to expect but a danger signal that never appeared, is it wonderful if such a course of training should insensibly lead to a dangerous confidence that what had been would still continue, and tend to a negligent look-out?

If the fact be as I have stated, who among us would withstand the influence of such a monotonous daily course? I am therefore disposed to compassionate this man, as a victim of a vicious system. That he did not see the "Danger" signal, I believe; but I also believe that he neglected to look for it, in the faith that all would be as heretofore.

There is, however, another matter to which I wish to draw some attention. We have been told that the Block System was to be an infallible security against these accidents. I have no intimate knowledge of the working of this system, but I have always understood that the line was kept blocked, and that a train was not allowed to pass a station without having received a telegraphic message from the station in advance that the line and station were clear. If this be the true theory, how came the Express to pass Wembly, a station some miles nearer to London than Harrow—the station at the latter place being obstructed by the train of empty waggons? Is it possible that following the Negative System of *prefixing the Semaphore signal* in anticipation of a train, Harrow had telegraphed to Wembly "line clear," in expectation that the waggon train would be clear of the line in full time. It seems very probable that the waggon train would have been well out of the way, had it not been for the fracture of a coupling, by which a part of the train was left upon the line; and the margin of time which would have sufficed to shunt the train as a whole became insufficient to do it when separated into two parts.

From the facts brought out at the Coroner's Inquiry it appears that so soon as it became evident that the waggons would not be clear of the line in time for the Express to pass, all became consternation and alarm. The "Danger" signal was then set, if not before; a telegraphic message was sent to Wembly to "stop the Express." Messengers were sent out to collect a staff of platelayers to go down the line to lay "fog signals." Except upon the supposition that the line had been telegraphed as being clear, I cannot understand the necessity for all these supplementary measures of protection, assuming the Block System to have been in operation. During all this anxiety and effort, the only person who could stop the train is tearing away through fog at fifty miles an hour, and this fact leads to the conclusion that he was acting under some authority, real or supposed, that the line was clear before him. The message to Wembly failed to intercept the train; the danger signal failed to arrest the attention of the engine driver; and in like manner the platelayers failed in their mission, having only proceeded a short distance from the station and fixed one fog signal, when the train rushed past them to destruction.

I wonder if these facts will induce in the minds of those who may read these remarks the same train of reflections that are passing in my own mind. Is it not strange that all this effort should be necessary under a well organised system to stop a train, which under certain unavoidable circumstances is a matter of life or death, and which, making allowance for speed and space, ought to be as certain and as easy as to stop a carriage on the highway? And yet in this case, notwithstanding Block System and all other appliances that could be brought to bear, the one thing necessary to save these people from destruction could not be accomplished.

Would it not be better to reverse the order of proceeding, so that instead of having to stop a train in the presence of danger, it shall only proceed on being assured of safety?

I now propose to apply the Affirmative System of using the ordinary Semaphore signal to the circumstances attending the fatal catastrophe at Harrow, with the view of showing how different would have been the result.

The casualty occurred by the Express running into Harrow station—a train of waggons being shunted across the line at the time.

The signal, on the Affirmative System, be it remembered, is always fixed at "Danger;" that is, to stop a train.

Now, suppose this same shunting to be in operation with every reasonable probability of its being completed before the Express was due. There is no unnecessary hurry beyond a natural desire to get the line clear, so as to avoid delay to the Express. Unfortunately, a coupling failed, and rendered this impossible. There would be much mortification, but no alarm, the "Danger" signal standing a barrier to the approach of any train; and it cannot be altered but by the deliberate act of those who are engaged in clearing the line, so that all is calm, collected effort, without distraction or fear of danger. To complicate matters, there was a fog outside; but although it may be a cause of delay, it cannot be a cause for alarm. They know that however dense the fog, the engine driver *must find the signal*, and ask permission to proceed, before venturing to enter the station.

The engine driver on his part leaves Euston with a knowledge that the line is blocked; that at every station he will find the "Danger" signal against him; and that he will have to obtain permission before he can pass. To avoid delay he will therefore seize the earliest moment at which he comes within view of the signal to sound his whistle; when, if the line be clear, permission will be accorded to him, by his seeing the signal arm depressed to the "All right" position. As matters stood at Harrow, finding himself in a fog and unable to see the signal from the usual point of view, he would have crept slowly on until he could see the signal, and then by his whistle he would have requested permission to pass. But under the circumstances in which the station was at that time, there would have been no response. His only course would have been to wait until, the obstruction being removed, the necessary authority would be given by the signal being depressed by the hand of some one on the spot while the train passed, when, the moment he takes his hand off the lever the signal again rises to its original position, as a protection against all approaching trains. I cannot avoid the conclusion that had the Affirmative System been in operation, in all human probability no casualty would have occurred; indeed I am quite unable to see the possibility of accident wherever the system is rigidly enforced and acted upon.

Before concluding I wish to say a word as to this Block System, which has been the subject of much laudation, but which has so signally failed in this and very many other instances.

When, some years ago, the Telegraph Block System was about being introduced, as a means of train signalling on Railways, I ventured to express an opinion adverse to its adoption. Invaluable as the telegraph is for the general purposes of railway management, I could see nothing whatever to recommend it for the purpose to which I have alluded, while it appeared to me to be in many respects liable to very serious objections.

The experience we have had of its practical operation has confirmed me in the opinions I formed in the early stages of its introduction. The increasing liability to accidents which for some time past has attended Railway travelling, shows that it has failed to realise the object of those who looked to it as a means of safety; and I believe that it has been the cause, direct or indirect, of many serious accidents. It has all the bad qualities belonging to the Negative System, in addition to others from which that system is exempt, without, as far as I can see, one redeeming feature.

Bearing in mind one of the conditions which I consider essential to ensure any degree of safety, the Telegraph Block System appears to me to have been self-condemned from its first introduction. The condition to which I refer, and which I have explained at length in connection with the Negative and Affirmative Systems, is this—that the engine driver, who alone has the power of controlling the movements of the train, should have an absolute knowledge of the safety or otherwise of the road immediately in advance of him, at all places liable to obstruction, so as to enable him, by a prompt exercise of the power in his hands, to avoid a collision.

The Telegraph Block System not only fails to afford to the engine driver this necessary information at the moment of his approaching a station, but it is in this respect more defective than the old mode of signalling under the Negative System.

Take the case of two stations (A and B) ten miles apart. If I understand the Block System correctly, a train approaching A would not be allowed to proceed until B had telegraphed "line clear." It would take fifteen minutes for an express train to cover the ground, and to avoid delay B would send his message so as to be received at A some little time before the train would arrive at that station. The information upon which the train would be allowed to pass A would thus have reference to a state of things that existed at B twenty minutes at least before its arrival at that station. This is not the sort of information that an engine driver requires, to protect himself and passengers; it is of no earthly use to him to know that twenty minutes ago the line was clear at B. What he ought to know, and what it is essential he should know, is, the actual condition of things at the station which he is at that moment approaching.

In so far as this vital point is concerned, the Block System is neither more nor less than an elaborate and costly mode of that prefixing the signal which I so strongly condemn under the Negative System, but which is there done in a less objectionable way.

In other respects I see grave objections to the use of the telegraph for train signalling, where instant and prompt action is frequently required, and where error or failure may be productive of disaster.

In the first place, the mechanical arrangements connected with the telegraph are so delicate in their parts as to be very liable to derangement.

Then it is extremely susceptible of atmospheric influence, so much so at times as to make it difficult if not impossible to pass a message. Its manipulation is effected by signs so minute and so rapidly indicated, as to be easily liable to error or misconception. It requires two persons specially educated for that purpose and the concurrent attendance and attention of these two persons at a distance from each other, which cannot be always relied upon, especially where the work is not continuous, and is required only at uncertain intervals. Its operations are conducted in secret, that is, not open to public view, and therefore it affords no security for that attention to duty which at any moment may be demanded. And lastly, the operators are, like other people, liable to error, and it is not difficult to realise the possibility of such an error, either on the part of the sender or the receiver of a message, as might entail serious consequences; and especially is this liable to be the case in the presence of extreme danger, when a degree of coolness and presence of mind is necessary which every one does not possess. Many instances of failure under such circumstances are known to have occurred, but many more have doubtless happened where detection was impossible.

The essential qualities requisite in a signal for train purposes are, simplicity, durability, and publicity. Simplicity of construction, so as to be not liable to derangement, and easily repaired; simplicity in the manner of working, so as to be within the power of any one to produce the effect required; durability of the materials of which it is constructed; publicity in respect to its position, so as to be seen by everybody; and publicity also as to the signals it conveys, speaking a language that everybody can understand.

These qualities are to be found in the most compact and useful form in the Semaphore signal, which, when rightly used in connection with a well-organised system, will be competent for all the purposes of train-signalling.

The question now is, as to the future, what is to be done, and who is to do it?

It is impossible to believe that matters will be allowed to remain as they are, and yet I see no probability that any change will be effected by the voluntary action of Railway authorities.

Railway Shareholders have a double interest in this question. As part of the public, their lives and limbs are in constant jeopardy; and as Shareholders their property is sacrificed to compensate for loss of life and personal injuries, which are in a great majority of cases as cruel as they are needless. One would naturally suppose that they would exercise the powers they possess, to bring about some change, and doubtless they might do very much more than they have done.

The large majority of Railway Shareholders, however, take but little interest in anything beyond the dividend; hence whatever influence they possess in right of their holding is, through the proxy system, placed in the hands of the Directors and their friends, so that with a constitution nominally democratic, the government of a Railway becomes a despotism exercising irresponsible power; and so manifest is this to that small section of Shareholders who would be disposed to make an effort to improve the state of things, that they decline to give an apparent sanction to the proceedings at Railway meetings by their presence, knowing that as regards any influence which they can exercise they might just as well stop at home.

I should not allude to the pecuniary losses which Shareholders sustain by these casualties, did not they serve as a measure by which to estimate the sufferings which the public are called upon to endure, and as an indication of the increasing fatality which for some years has attended Railway travelling. In this respect Railway accounts furnish unmistakeable evidence, not only of the serious extent of the evil, but of its tendency to grow. I find by reference to the accounts of the London and North Western

Railway that in the year 1863 the sum paid for compensation and losses was £44,117, and that in 1866 this item had increased to the sum of £113,952, whilst for the four years ending 1869 the average sum paid for compensation and losses amounted to £120,000 annually.

It thus appears that the charge upon the Company under this head has increased during the seven years from 1863 to 1869 in an almost threefold ratio, and there is no reason, so far as I can see, why during the next seven years the same ratio of progression may not be continued. And what is still more remarkable is, that during the same seven years the number of passengers carried increased only 12½ per cent., while the sum paid for compensation and losses has increased 172 per cent.

These figures, be it remembered, take no account of the great destruction of property which attends these collisions, in engines, carriages, waggons, &c., the cost of which is included in the general repairs.

Is it possible to believe that this wholesale destruction of life and property, and the far more serious (because more extensive) personal injuries by which great numbers are maimed for life,—is it, I say, possible that such a system can be allowed to continue?

I think it is a duty attaching to a fault-finder to be prepared to suggest a remedy, but more especially is this the case when so grave a charge as that of unnecessarily sacrificing human life is involved.

In recognition of this duty, I have suggested a remedy. I have done this in every form that was likely to produce an effect. I have endeavoured, whenever opportunity served, to impress Directors and Managers with my own convictions, some of whom have frankly admitted the greater safety of the Affirmative System, and are at this moment as thoroughly convinced of it as I am myself; I have appealed to the public through the press; and yet nothing is done.

It is not for me to analyse the motives which prompt this resistance to all change, but I think that the public, for whose convenience, comfort, and benefit these Railways were established, have a right to be informed why a system fraught with such risks and dangers is so pertinaciously adhered to. If anyone can suggest a better plan than that which I propose, by all means let it be adopted; but no such better plan has been proposed. The Affirmative System of signalling has been before the public, under my advocacy, for nearly twenty years; and from time to time, as I have brought it under their notice, I can without hesitation say that apart from the official class it has met with general approval; and it now stands alone as the one remedy for an acknowledged evil. Why then is it not tried?

Are railway passengers to be systematically killed and mutilated without an effort to prevent it? If it were true that along with the safety it secured it would involve some slight delay, this is a matter for the public to determine, whether they prefer delay to destruction or not.

If the plan which I propose were based upon some crude and fanciful theory as yet untried, it might account in some measure for the passive resistance with which it is met by the Railway authorities. So far however from this being the case, it appeals to the commonest of human instincts, by which we were taught at a very early period to look before us and ascertain the safety of our path before we venture forward. Nor is it an untried system in connection with railways; and what is more, wherever it has been tried it has never failed to manifest its superiority as a means of safety for train signalling.

It will be a matter of surprise to those who are not intimately acquainted with the working arrangements of a Railway, to be told that the Affirmative System, pure and simple, has been and is now in operation at every junction station throughout the kingdom. It is not only so, but no Railway manager would dare to work a junction signal on any other principle. The reason is obvious; a junction, where one line branches out of another, is accounted more liable to danger from collisions than other parts of the line, and hence the Affirmative principle is adopted for greater security, and the result proves the wisdom of the discrimination, seeing that a junction, though by the nature of the duties it has to fulfil it is considered to be attended with more than ordinary danger, by the application of the Affirmative System to the signal is rendered the safest portion of a Railway, an accident at a junction being as rare as accidents at other parts of the line are of common occurrence.

I have been in the habit for the last twenty-five years of passing over a junction where upwards of two hundred trains pass daily, and I do not remember a single instance of serious accident; and in proof of the adaptability of the same system to other parts of a Railway I must not omit the fact of my having worked a Railway seventy miles long, and through a very populous district, for more than two years, the Affirmative System being in operation over the whole length of the line, with the most perfect success and freedom from accident.

The natural question arises why, if the Negative System, based as it is on preconcerted arrangements, is not considered safe to rely upon at junctions, is it accounted sufficiently so at stations on the main line, where the liability to obstruction is of more frequent occurrence, although of a different character? To this question no satisfactory answer can be given, nor has any been attempted, beyond the assumed possibility of delay, with respect to which I will only repeat that the Affirmative System will offer no appreciable obstacle to whatever speed it is in other respects deemed safe to adopt.

The universal application of the Affirmative System to junctions is a clear admission on the part of Directors and Managers that it affords greater security than the Negative System,—that they dare not rely upon their rules, regulations, and preconcerted arrangements where safety is an object to be secured.

In further proof of this want of confidence on the part of Railway authorities in the Negative System now in operation, I will refer to their proceedings whenever Royalty takes the rail.

Notwithstanding their rules and regulations, it is considered necessary to make it known on the whole line of route, that Her Majesty intends to travel from Windsor to Balmoral on a given day, and that the train will pass each station at a given time. Notwithstanding these special precautions, they are still doubtful of their preconcerted arrangements, and deem it necessary to make assurance doubly sure, by sending a pilot engine immediately in advance of the Royal train. Now what is the meaning of this pilot engine? What purpose is it to serve? It is to do that for the security of Her Majesty which I ask should be done for the safety of her subjects, though at much less cost and trouble, viz., to ascertain that the line is clear immediately in advance of the train.

Let it not be supposed that I am carping at these elaborate precautions, or drawing any invidious distinction between the caution exhibited in the case of the Queen and the neglect of it in the case of her subjects; on the contrary, I consider them wise and absolutely necessary, the more so from the loose and vicious system under which the line is ordinarily worked. The only moral that I want to draw from these facts is the proof they afford that where safety is made superior to all other considerations the authorities dare not rely upon their preconcerted arrangements, and the further proof that they afford of the admission on their part that safety can only be secured by the adoption of the principle on which the Affirmative System is based, viz., that the state of the road shall be absolutely ascertained immediately in advance of a train, at all points where possible obstruction is to be apprehended. On the one hand the insecurity of the present system is admitted, and on the other the principle of the Affirmative System is conceded.

These remarks have extended much beyond the limits that I contemplated, when, seeing what I fancied to be a disposition on the part of the public to resign themselves to endure that which apparently could not be avoided, I felt it a duty to endeavour to prevent any such hopeless feeling taking root.

I have therefore had but one object in view, viz., to present the subject to the minds of my readers as it appears to my own, and to leave nothing unsaid that might tend to establish as strong a conviction as that which I entertain, that the casualties incident to railway travelling result in a great measure from a wrong application of the means at our disposal.

However imperfectly I may have performed my self-imposed task, I trust that I have made the sincerity of my own convictions clear, and that in bringing into question the existing system of railway management, in so far as train signalling is concerned, I have said nothing that can in any degree leave an unpleasant feeling in the minds of those who are more directly responsible, or that will prevent them giving to the subject a fair and unprejudiced consideration.

And now that my labours are drawing to a close, in casting my eye over what I have done, the feeling that is uppermost in my mind is one of surprise that it should be necessary to say so much in advocacy of a proposition so self-evident;

for what after all does it amount to more than this—that we should do that in connection with a Railway which by instinct we adopt as the rule of our course through life? There is neither merit nor mystery in its conception, and it resembles nothing so much as the common sense of common people.

Timberhurst, near Bury,
20*th January*, 1871.

THE SEMAPHORE SIGNAL:

ITS USE AND ITS ABUSE.

A brief comparison between the Negative System of using the Signal now in operation, with the Affirmative System proposed to be adopted.

NEGATIVE.	AFFIRMATIVE.
I.	I.
The signal is balanced so that by its own action, when set at liberty, it will assume the "All Right" position.	The signal is balanced so that, when set at liberty, it will assume the position of "Danger," that is, to stop an advancing train.
II.	II.
Rules and regulations are so far relied upon as to justify the assumption of a "Clear Line."	Notwithstanding rules and regulations, the possibility of a failure in their execution is recognised as sufficient to justify the assumption of an "Obstructed Line."

NEGATIVE.	AFFIRMATIVE.
III.	III.
The "All Right" signal is prefixed some time previous to the arrival of a train. In the absence of a signal to the contrary, the engine driver *infers* that the line is clear.	The "All Right" signal being given at the moment of a train's approach, and in view of the engine driver, the safety of the line is directly *affirmed.*
IV.	IV.
The line of railway is always open, except when closed by the "Danger" signal.	The line of railway is always closed, except when opened by the "All Right" signal to allow a train to pass.
V.	V.
In case of obstruction, the signal arm must be raised to the position of "Danger" to stop an approaching train.	In case of obstruction, nothing is required to be done to stop an approaching train, the signal being constantly in the position of "Danger." The train stops in the absence of authority to proceed.
VI.	VI.
A train approaching a station passes on in the absence of a "Danger" signal.	A train approaching a station cannot pass on without a change in the position of the signal to that of "All Right." This signal is only given in response to the engine driver's whistle, and is a distinct assurance of the safety of the line in advance.

NEGATIVE.	AFFIRMATIVE.
VII.	VII.
The "All Right" signal, by authority of which a train proceeds, being prefixed some time previous to the approach of a train, indicates only the state of things at the time of such prefixing.	The "All Right" signal, when given in view of an approaching train, is a true indication of the state of things then existing, and is an assurance to the engine driver that the line is "Clear."
VIII.	VIII.
To stop a train in case of obstruction, the presence of some one on the station is necessary to perform an act within a given time. The signal must be raised from its normal position to that of "Danger."	To stop a train in case of obstruction, no person is required; the signal being always at "Danger," there is nothing to be done; the train stops as a matter of necessity.
IX.	IX.
The contingencies are, that the "Danger" signal may not be set; or, if set, not in time.	The "Danger" signal is always set.
X.	X.
The engine driver may not see the "Danger" signal when set.	The engine driver cannot avoid seeing the "Danger" signal; its change to the "All Right" position being necessary to allow of his proceeding.

NEGATIVE.	AFFIRMATIVE.
XI.	XI.
Neglect involves possible collision.	Neglect involves delay only.
XII.	XII.
In the absence of a signal-man the train proceeds.	In the absence of a signal-man the train stops.
XIII.	XIII.
A station master or signal-man may, according to the rules, prefix the signal in anticipation of a coming train, and having done so, leave the station.	The presence of a station master or signal-man is compulsory to avoid delay; the signal to proceed having to be given in response to the engine driver's whistle.
XIV.	XIV.
An engine driver may pass into and through a station without seeing any movement of the signal, or other indication that any one is in attendance.	The change of the signal from its normal position of "Danger" to that of "All Right," is given in response to the engine driver's whistle and within his view, clearly indicating the presence of some one in charge of the station.

NEGATIVE.	AFFIRMATIVE.
XV.	XV.
The effect of constantly passing signals which have been prefixed is to induce a careless look-out on the part of the engine driver. As a rule he finds the signal in one uniform position, viz.: "All Right;" and this state of things being continued, after a time he is insensibly led to rely upon it as a permanency; so that when it does happen that the "Danger" signal is set against him, he runs the risk of *not seeing it, or of not being prepared to act upon it with sufficient promptitude.*	The engine driver having the signal constantly against him, its effect is to render a sharp look-out necessary to avoid delay. Having to obtain through the signal permission to pass, he will naturally sound his whistle the moment he comes into view of it, when, if all be right, he will receive an instantaneous reply to that effect. This practice tends to keep up the attention of the engine driver on approaching all stations, and the habit thus acquired will induce a better look-out along the whole line.
XVI.	XVI.
In the case of a fog, a blown-out lamp, or any other accident to a signal, by which the engine driver's view of it is either obscured or prevented, he is apt to rely upon the line being clear, as he has usually found it, and to proceed accordingly.	In the case of a fog, a blown-out lamp, or any other accident to a signal, by which the engine driver's view is either obscured or prevented, he cannot proceed without *finding the signal* that he may obtain permission to pass; or, if this be impossible, he must proceed so cautiously to the station as to avoid the possibility of collision.

NEGATIVE. XVII.	AFFIRMATIVE. XVII.
It is difficult, if not impossible, to exercise such a check and supervision over the proceedings of those on whom the safety of the train depends, as to be able to detect any neglect of duty on their part. So long as no accident occurs it is taken for granted that the rules and regulations are strictly observed, and *it requires an accident to prove the contrary.*	It is quite possible to detect a breach of the rules in so far as their observance is necessary to the safety of a train, *without waiting for an accident.* A travelling superintendent seated in a train, without his presence being known to the people along the line, can see for himself whether the rules laid down are observed or not. He can see if the signal is prefixed in anticipation of a train; or if it be changed from its normal position of "Danger" before the sound of the whistle. He can see if the engine driver sounds his whistle before coming in view of the signal. He can see if there be any unnecessary delay on the part of the signal-man at the station in replying to the whistle of the engine driver. He can detect an engine driver, should he venture to run past the "Danger" signal; and he can see if the signal is allowed to resume its original position immediately after the passing of the train.

HE 1783 .G7 W9
"Look before you leap."
Stanford University Libraries
3 6105 041 785 051

STANFORD UNIVERSITY LIBRARIES
CECIL H. GREEN LIBRARY
STANFORD, CALIFORNIA 94305-6004
(415) 723-1493

All books may be recalled after 7 days

DATE DUE

F/3 JUN 30 1996
MAY 31 2001